

# **THE MODIFIED QUINT CONCEPT**

## **EXECUTIVE PLANNING**

**BY: Tony L. Langston  
Wilson Fire/Rescue Services  
Wilson, North Carolina**

**An applied research project submitted to the National Fire Academy  
as part of the Executive Fire Officer Program**

**May, 1998**

## ABSTRACT

One of the greatest challenges for the fire service is maintaining the same level of service and providing more effective means of doing business. Utilizing the technology of quint fire apparatus may be one way of delivering better fire protection services, with basically the same manpower.

At the present time no formal plan exists for the future justification of additional quints, and how they should be staffed. The purpose of this research project is to identify what are the practical considerations that affect the selection and assignment of quint apparatus within the Wilson Fire/Rescue Services.

This research project utilizes an action research methodology. The following questions were answered while completing the extensive literature review.

1. Can quints replace truck companies?
2. What are the advantages and disadvantages of quints?
3. How does staffing effect quints and fireground operations?

The procedures included an extensive literature research of research papers. Articles related to the subject matter have been read and telephone interviews have been conducted with other fire departments to see if and how they are utilizing quints at the present time.

The results of this research project confirmed that the majority of fire departments have quints, but use them primarily as engine companies. Other than those fire departments using the total quint concept, no one had a plan in place to change the role of quints in their respective departments. At least four personnel on each apparatus was considered to be minimum

standard for maintaining the safety of firefighters on the fire scene.

The recommendation concluded from this research project was that Wilson Fire/Rescue Services should undertake further study before purchasing additional quints, and better utilization should be made of the quint we have.

## TABLE OF CONTENTS

<b>Abstract.....</b>	<b>ii</b>
<b>Table of Contents.....</b>	<b>iv</b>
<b>Introduction.....</b>	<b>1</b>
<b>Background and Significance.....</b>	<b>2</b>
<b>Literature Review.....</b>	<b>5</b>
<b>Procedures.....</b>	<b>15</b>
<b>Results.....</b>	<b>16</b>
<b>Discussion.....</b>	<b>21</b>
<b>Recommendations.....</b>	<b>22</b>
<b>References.....</b>	<b>25</b>
<b>Appendix A (Recommended Quint Realignment).....</b>	<b>27</b>

## INTRODUCTION

The fire service in general has always been a manpower intensive operation, which has demanded considerable manpower and equipment to maintain effective operation on the fire ground. The demand by the public for increased efficiency and reduction of cost have caused a shrinking budget and reduction in personnel for the Wilson Fire/Rescue Services.

The 1998/1999 budget report shows a significant increase of 86 percent sick leave usage, 38 percent incident responses, 18 percent response area, 18 percent increase of hydrants maintenance and 40 percent increase of vacation taken. With a mandatory reduction of the work force in 1995, the department was reduced from 89 to 82 personnel, which includes reduction of staff positions from eight to five. The Wilson Fire and Rescue Services feels they need to be more proactive in planning for the future. Fire Chief Don Oliver believes we can do a better job of justifying the personnel and fire equipment needed to maintain our current level of service (Don Oliver, personal interview, January, 1995). Given our current reduction in personnel, the chief officers feel we need to justify additional staffing along with the equipment necessary for safe operations on the fire ground. In 1996, the Wilson Fire/Rescue Services placed a 75 foot quint in service, and are expecting to place a 110 foot quint in service by October, 1998. Although the quint is presently staffed with only three personnel, it has given the department the benefits of: tag axle maneuverability, versatility of a 75 foot ladder, a 1250 gpm single stage pump and a 500 gallon water tank.

At the present time no formal plan exists for the future justification of additional quints and how they should be staffed. The purpose of this research project is to identify what are the practical considerations that affect the selection and assignment of quint apparatus within the

Wilson Fire/Rescue Services.

An action methodology was used which included a literature review and telephone interviews.

The research questions to be answered are as follows.

1. Can quints replace truck companies?
2. What are the advantages and disadvantages of quints?
3. How does staffing effect quints and fireground operations?

## **BACKGROUND AND SIGNIFICANCE**

Incorporated in 1849, Wilson, North Carolina is ideally situated in Eastern North Carolina only 50 miles east of Raleigh, the state's capital and 100 miles west of the Atlantic Ocean.

Though a small city of approximately 22 square miles and 40,000 people, Wilson is diversified in the world of business. It is home to the headquarters of Branch Banking & Trust Company, Merck Pharmaceutical, Firestone/Bridgestone, Foster Forbes and many other widely recognized corporations.

### **Wilson Fire/Rescue Services**

Since its beginning, the City of Wilson has provided fire service protection to its citizens. Originally, this service was provided by a handful of volunteers and progressed to 82 paid personnel.

The department offers state of the art service and continues to pioneer new ways to serve the community and protect lives and property through highly trained and well-equipped fire suppression forces. Services include fire responder emergency medical care provided by the

closest engine company, technician level hazardous material's response team, proactive fire prevention inspection programs and award winning innovative public education programs.

The city fire department is the only career department in the county. The fire department has recently updated mutual aid agreements with the 11 volunteer fire departments serving the other communities in Wilson County.

In response to a target emergency response time of four minutes or less, a fire station location study was done in October of 1994. Due to this study and station relocation, the four minute response time has improved to cover 97 percent of the city. The relocation of two new stations was commenced and completed in late 1995.

In keeping pace with the demand of our citizens "to do more with less," the Wilson Fire/Rescue Services has undergone a third reorganization in five years. At the direction of the City Council, the city's workforce was reduced by nine percent in 1995. The Wilson Fire/Rescue Services was required to eliminate seven positions. A task force composed of representatives from all areas and ranks of the department identified two deputy fire chiefs, one battalion chief and four firefighter positions that could be eliminated.

In 1997, the Wilson Fire/Rescue Services reorganization provided four, 40 hour division chiefs to function as division heads under the direction of the fire chief. The following are areas of responsibilities of each division chief:

Operations Division Chief - Responsible for emergency response and management, water systems, equipment and apparatus maintenance, communication system and safety program management.

Fire Prevention Division Chief - Manages inspection programs, public education, fire investigation and water system maintenance.

Resource Development Division Chief - Manages personnel development programs and coordinates department training programs.

Administrative Division Chief - Budget administration coordinator, information management, facility maintenance and records management.

In addition to the responsibilities listed above, one week a month the four division chiefs are required to respond to all emergencies whenever contacted. Division Chiefs' may be asked to rotate to different job responsibilities every 18 to 24 months. By rotating assignments it is necessary to be familiar with the duties and responsibilities of all Divisions.

A minimum daily operational duty strength of 20 personnel per shift dictates that engines and truck companies be staffed with three personnel and squad company with two personnel. During regular business hours there are six staff and four fire prevention personnel available as additional resources. Some of these resources are not generally available for quick response due to their heavy administrative duties.

At the present time no formal plan for future justification of additional quints and how they should be staffed.

The purpose of this research project is to identify the practical considerations that effect the selection and assignment of quint apparatus within the Wilson Fire/Rescue Services.

As stated in Executive planning course at the National Fire Academy, fire service managers have placed a greater emphasis on the planning, organizing, controlling, evaluating service delivery and available resources (Student Manual, pgs. 1-3). This research will help this



author to access and improve the effectiveness of current organizational resources and make recommendations for improvement.

## LITERATURE REVIEW

The literature research in the subject of quints revealed that this type of fire apparatus is used in many different ways throughout the United States. Opinions on quints and how they are used vary among departments surveyed.

The International Fire Service Training Association (IFSTA) published manual, Fire Apparatus Practices describes the elements of quints which are: an aerial ladder with a complement of ground ladders, a pump, water tank and fire hose compartment, all which comply with NFPA 1901 specifications (1980, pg. 10). This 1980 definition of quints is still true today, but they must also provide space for all personnel to ride safely, carry all the needed extra equipment for pumper and truck company operations, as well as rescue and EMS equipment (Shaper, 1991).

The St. Louis Fire Department went a step further by utilizing quints in a total quint concept (TQC). This was in response to a major budget cut, which made its traditional engine/truck system incapable of delivering adequate fire and rescue service to the public. This concept operates under the premise of flexible response around quintuple combination apparatus. Assignments must be based on what operations must be performed at the fire scene, rather than on what type apparatus you are responding on. By changing the system, St. Louis Fire Department increased the number of firefighters at each company to four members per shift.

Other plans call for three member engines and two member truck companies (Gerner & Schaper, 1996).

Captain Tim Hatch writes in April 1996, *American Fire Journal*, training firefighters to perform engine and truck company operations is the key to success, along with proper location of quints and adequate staffing. If five additional personnel are available, some simultaneous operations can be accomplished, but it will take careful coordination of personnel. He also writes that standard operation procedures must be developed for quint operations, depending on whether the quint is first, second or third company on the scene. Generally, the first company would operate as engine and second arriving company would operate as a truck company (Hatch, 1996).

In 1996, the fire department in Richmond, Virginia proposed a plan to sell 20 of their pumpers and eight aerial ladders. They were replaced with fourteen 75 foot quints, four 100 foot quints, one 100 foot platform, three heavy rescue vehicles and nine medium duty rescue/pumper rapid response vehicles. Because quints are multi-functional, the department reduced the companies from 26 to 23, and decreased the department by 50 employees. Richmond City Council approved this innovation proposal by Chief Mcelfish, because of 13 million dollars overall savings to taxpayers over the next 15 years, better level of service and enhancement of firefighters safety (Mcelfish, 1988).

Frank Schaper points out many advantages of quints in a June, 1991 article in *International Society of Fire Service Instructors Magazine*:

### **ADVANTAGES**

- Obvious engine, truck company and rescue capabilities.

- Maximum manning is easier to justify using the quint concept.
- Insurance Services Office gave some cities credit for both truck and pump in their rating analysis.
- They provide adequate space for all personnel to ride safely.
- Carry all equipment needed by both engine and truck companies (Shaper, 1991).

Donald Loeb points out other advantages in an article from 1992 Fire Chief Magazine.

- Heavy hitter in high hazard areas.
- Less congestion on a fire scene.
- The aerial needs fewer personnel to provide safe roof access.
- Operator can protect exposures while crew starts interior attack.
- A good assortment of ground ladders to choose from (Loeb, 1992).
- Tag axle assembly would cost an additional \$20,000.00, but would eliminate the need for tillerman and increase maneuverability significantly (Interview with Mechanic Mike Winstead, Wilson Fire/Rescue Services, February 26, 1998).

## **DISADVANTAGES**

In 1983 Vann Benson speaks of some disadvantages in an article in Fire Chief Magazine. Some of the disadvantages of the quints mentioned were: too big and heavy, too complicated, too expensive, high maintenance and repair cost (Benson, 1983). Roger Strock's research points out that when various functions normally implemented by several apparatuses are combined into one, you lose the versatility of that apparatus when repairs are needed (Strock, 1994). North Carolina General Statue 20-118 "states the gross vehicle weight must not exceed

20,000 pounds on single axle and 38,000 pounds on tandem axle assembly.” The added weight would call for a tandem axle assembly, which would add cost and loss of some maneuverability (Knotes, 1995).

Chief Donald Loeb points out two important facts in an article about quints in Fire Chief Magazine. He states, “the length and height of quints are extremely important when you are considering running this piece first-out on streets, tight turns, limited maneuverability of the truck, parking, etc., and sometime quints may need to be placed exactly where it is going to be the most good.” (Loeb, 1992, pg. 217).

Captain Hatch from Fort Worth Fire Department writes that quints need to be located in slower stations, because it doesn’t make sense to wear out a piece of equipment that costs up to half million dollars making thousands of EMS calls (Hatch, 1996).

Captain Lorbacher of Durham Fire Department says they do not operate quints at the present time, but plans on looking at the possibility when their new station opens this year. They presently run three engines, one truck, one rescue company and one battalion chief on all structure fires. All apparatus are staffed with four personnel, but due to vacations and sick leave they generally only respond with three personnel. The lengths of the four truck company ladders vary between 75 and 100 feet (Presley Lorbacher, phone conversation, February 24, 1998).

Maintenance supervisor Tommy Daughtridge of the Rocky Mount Fire Department stated that they have one 75 foot quint and one 85 foot platform truck. The truck company responds with three personnel and the quint primarily operates as an engine company with four personnel. Some disadvantages Mr. Daughtridge noted of the quint were that the hose bed was

too small for the amount of hose they preferred to carry on engine company. Because of the need for the quint to be close to the building to be effective, it was sometimes too dangerous for outside water stream application. Some advantages of the quint they liked were the maneuverability of the truck and water application by remote control nozzle. Mr. Daughtridge also noted they were familiar with the total quint concept, but did not believe in it at this time (Tommy Daughtridge, Rocky Mount Fire Department, Maintenance Supervisor, telephone interview, February 19, 1998).

Assistant Chief David Spears of Greensboro Fire Department states they operate six quints primarily as truck companies, but they could be used as engine companies if needed in that capacity. One disadvantage he noted was the lack of maneuverable compared to engines. The quints are staffed with four or five personnel depending on vacation and sick leave usage. Chief Spears said they were familiar with the quint concept that the St. Louis Fire Department uses. Future staff reductions may force them to consider the total quint concept (TQC) (David Spears, phone conversation, February 19, 1998).

Captain Don Horton, Public Information Officer of the Richmond, Virginia Fire Department stated, "they were using the total quint concept and would complete purchasing all quints in April of 1998." They were purchasing Pierce quints, with 75 foot ladder on a tandem axle. One reason for implementation of quint concept was to maintain the same level of service with reduction of the department by 50 members, which was done through attrition. Standard operating procedures for the total quint concept was developed with the help of National Fire Academy and they were still in the training and planning process. The maneuverability of the quints with tandem axle and obscured visibility of ladder blocking stoplight were some

disadvantages noted, but these had been overcome through continuous training and practice. Minimum staffing of four personnel on quints along with seven personnel on a heavy rescue company allows for 17 to 18 personnel available on a fire scene, compared to 12 personnel on a scene with traditional engine and truck company operations. Captain Horton explained this was accomplished by responding three quints and one rescue company on structure fires compared to two engines and truck response under the traditional system (Don Horton, phone conversation, February 21, 1998).

In Florida, District Chief Donald King of the Gainesville Fire and Rescue reported that they operate one 75 foot quint, six engines and one rescue vehicle. All companies are assigned four personnel, except the rescue company which operates with two firefighters. Due to vacation, kelly days and sick leave, frequently the companies are in service with only three personnel. When four personnel are assigned to a quint, it functions as a truck company, with three personnel, it operates as an engine company. Chief King reported two disadvantages that he had observed with the quint, one being the lack of maneuverability of a tandem axle, and two being the 75 foot ladder was too short for some rescue operations. Gainesville had no immediate plans to change the role of quints in their department (Donald King, phone conversation, March 9, 1998).

As far back as 1966, the International City of Management Association (ICMA) recommended that engine companies maintain a minimum of five personnel while those operating in "high value" areas require seven personnel. The ICMA further states that "ladder companies" are governed by similar manpower considerations. The demand by the public "to do more with less" makes this an unrealistic goal today, but critical tasks must still be performed

(Gary, 1997, pgs. 22-25).

To understand staffing requirements for quints and incident mitigation you must understand the critical tasks that have to be conducted by firefighters. The following is a summary of Liverpool Fire Department Standard Response Manual for moderate risk structures.

Attack-line - A 1 3/4 inch hose that produces 130 g.p.m. and is handled by two or three firefighters.

Search and Rescue - A minimum of two firefighters assigned to search for victims and remove them from danger.

Ventilation Crew - A minimum of two firefighters to open a horizontal or vertical ventilation channel when attack crew is ready to enter the building.

Back-up line - A 1 3/4 inch or 2 1/2 inch line that is taken behind the attack crew to cover the attack crew in case the fire overwhelms them or problems develop with the attack line.

Safety Crew - A minimum of one firefighter equipped with self-contained breathing apparatus and available near an entry point to enter the structure and rescue.

Exposure line - A 1 3/4 inch attack line manned by two firefighters and used to prevent fire expansion.

Pump Operator - One firefighter assigned to deliver water and maintain adequate pressure in attack line.

Water Supply - A crew of one or two firefighters who must pull the large diameter hose between pumper and hydrant.

Command - An officer assigned to remain outside of the structure to coordinate the attack, evaluate results and redirect, arrange for additional resources and monitor scene safety.

At a fire in an occupied structure, a minimum of eight tasks must be conducted in order to stop the loss of civilian lives, stop further property loss, and do so while keeping the risks to firefighter lives at a reasonable level (Gary, 1995).

Chief Edward Dawson's recommends in his research for Fall River Fire Department, five personnel on each quint. This is based on fire risk analysis and critical tasks such as fire attack, rescue and response times (Dawson, 1990).

In 1987, St. Louis Fire Department operated with three person engine companies and usually three person hook and ladder companies. Because of implementation of a total quint concept (TQC), they are now staffing quints with a daily minimum assignment of four personnel. Although the department was reduced in 1987 from 752 to 631 members, they now respond 28 members to a fire scene rather than 13 members under the old engine/truck system (Gerner & Schaper, 1995, pg. 43).

Tim Hatch writes in American Fire Journal in 1996 that by staffing quints with three or four personnel, they can be either an engine or truck but not at the same time. If five or six personnel are available, it can perform some simultaneous operations (Hatch, 1996, pg. 21).

In 1982, the NFPA's Fire Service Today published the results of a study conducted by the Seattle Fire Department. Based on a series of textbook training drills and live fire drills, the department calculated model effectiveness of various levels of manpower as follows:

	<u>3 persons</u>	<u>4 persons</u>	<u>5 persons</u>	<u>6 persons</u>
<u>Engine</u>	45%	59%	79%	100%
<u>Ladder</u>	n/a	57%	78%	100%



As even more telling statistics relate, per average hours disability associated with three person companies staffing was nearly 50 percent greater than those occurring when units were staffed with four and five personnel (Gary, 1997).

In December 1991, the Phoenix, Arizona Fire Department developed an evaluation system involving responding to and extinguishing a working fire in a single story residential structure of 2,000 square feet with no exterior exposures. The department concluded that to safely conduct an aggressive interior attack required 14 personnel. This was based on standard evolutions and critical tasks that needed to be accomplished, which equates to four personnel on pumpers and four on truck companies (Gary, 1997).

Research in 1994 by Curtis Varone of Providence, Rhode Island Fire Department revealed dramatic results on staffing. The study showed that four firefighter staffing led to a 23.8 percent reduction in injuries and a 71 percent decrease in time lost due to injury when compared to three person staffing. The research led to the conclusion that four person staffing substantially reduced the number and the severity of injuries compared with three person staffing (Varone, 1994).

In July of 1993, an amendment to NFPA 1500 was issued regarding at least four firefighters to be assembled on the scene of a working structure fire before interior firefighting could be initiated. In April of 1994 the NFPA standard council stated, “when a company is dispatched from the station together as a unit rather than from various locations, that the company should contain a minimum of four firefighters” (Varone, 1995, pg. 16).

The two Outstanding Applied Research Papers by Curtis Varone influenced this research by providing data which collaborates with data gathered by Wilson Fire/Rescue Service 1997/1998 budget document.

OSHA 29 CFR 1910.134 states, “once firefighters begin the interior attack on an interior structure fire, the atmosphere is assumed to immediately dangerous to life and health (IDLH) and 29 CFR 1910.134(g)(4) [two-in/two-out] applies”. This standard may be one of the most important safety advances for firefighters in this decade. The standard specifically addresses the use of respirators in (IDLH) atmospheres, including interior structural fire fighting. In these atmospheres, OSHA requires that personnel use self-contained breathing apparatus, that a minimum of two firefighters be on standby outside the structure to provide assistance or perform rescues (Marinucci, 1998). This regulation will have an important impact on the staffing level of quints and engine companies and possible changes in response procedures. North Carolina has an OSHA-approved plan and must enforce the two-in/two-out provision by July 1, 1998 in all fire departments.

Bill Manning, Editor of Fire Engineering Magazine explains the Occupational Safety and Health Administration (OSHA) federal regulation on respiratory protection, 29 CFR 1910.134 in simple terms.

The final rule says that an interior attack on a building fire (in an immediately-dangerous-to-life-and-health environment, defined by OSHA as anything larger than an incipient fire) cannot begin unless at least two firefighters are on the line and at least two firefighters are outside to effect a firefighter rescue should it become necessary. This is the well-known and well-debated “Two-In/Two-Out” rule. In addition, interior search must be accomplished in teams of two. Fireground staffing in many towns and cities is a disgrace, an insult to firefighters and the public. Hopefully, the final rule will arouse fire departments-and the city fathers-to change their attitudes (Manning, 1998, pg.4).

## PROCEDURES

The desired outcome of this applied research project was to develop a formal plan to anticipate the future justification for additional quints and how they should be staffed. The research procedure used in preparing this paper consisted of an extensive literature review to obtain what information was available on the practical considerations of using quints. The research was conducted by this author at the Learning Resource Center at the National Fire Academy in October of 1997. The research was action research in that the information gathered was applied to the actual, real-world problem of quint operations and the available personnel to perform effective operations.

In consideration of the information gathered at this point, the next step taken was the evaluation of how current North Carolina and out-of-state departments are utilizing quints. This author conducted telephone and personal interviews in January, February and March of 1998 with the following fire departments:

Rocky Mount Fire Department, Rocky Mount, NC

Greensboro Fire Department, Greensboro, NC

Richmond Fire Department, Richmond, VA

Wilson Fire/Rescue Services, Wilson, NC

Gainesville Fire and Rescue, Gainesville, FL

A list of evaluation questions was created for telephone interviews to lay the ground work for the analysis. The following questions were asked:

- (a) Does your department have quint fire apparatus? If so, how many?
- (b) Do quints operate as engine, truck or both?

- (c) What is the staffing level of quints and engine companies?
- (d) What are the advantages and disadvantages of quints?
- (e) Does your department have standard operating procedures for quints?

## **LIMITATIONS**

The limitations faced in this project included an inability to objectively measure the use of quints, because many departments do not use them and those that do, have different procedures. Several research papers were obtained through inter-library loan related to subject matter, but the information was mostly redundant.

Only a small number of fire departments were interviewed and most did not have a formal plan for quints, except for the Richmond Fire Department. Although, the St. Louis Fire Department uses the total quint concept (TQC), they could not be reached by phone after several attempts.

This author could not specifically study quint staffing, because most research data gathered was based on engine and truck company operations and that data was somewhat overwhelming.

## **RESULTS**

At the outset of this research project, three specific research problems were identified. This section will provide answers to the original research questions.

### **1. Can quints replace truck companies?**

The research and literature review did not necessarily recommend replacing truck companies with quints, but using quints can provide more versatility than truck companies. The

primary benefit of quints over engines is the ability to perform rescue and ventilation with aerial ladder while carrying equipment for both operations.

Large departments such as St. Louis and Richmond have adopted the total quint concept (TQC) in response to budget cuts and personnel reduction. Assignment must be based on what operations must be performed at the fire ground, rather than on what type apparatus used for response. This concept works well for them because of standard operating procedures, continuous training and more personnel available on the scene to perform critical tasks.

Of the departments surveyed, some operate the quint as an engine company or truck company depending on staffing. The Greensboro Fire Department operates quints primarily as truck companies. Other departments surveyed were familiar with the total quint concept (TQC), but had no plans to change the role of quints in the near future.

## **2. What are the advantages and disadvantages of quints?**

The literature review and telephone interviews revealed many advantages and disadvantages of using quints for truck and engine company operations. By changing to the total quint concept (TQC), the St. Louis Fire Department has observed several benefits such as more standardized training on one type apparatus and it was much easier for personnel to perform assignments when they only have to be familiar with one type of apparatus. Standard operating guidelines (SOG) require the first company to operate as engine and second arriving would operate as truck company.

Frank Schaper and Donald Loeb points out many advantages as listed below:

- Obvious engine, truck company and rescue capabilities,
- Maximum staffing is easier to justify using the quint concept,

- Insurance Service Offices may give credit for both truck and pumper in rating analysis,
- Provide adequate space for all personnel to ride safely,
- Can carry all equipment needed for both engine and truck companies,
- Heavy hitter in high hazard areas,
- Less congestion on a fire scene,
- The aerial needs fewer personnel to provide safe roof access,
- Operator can protect exposures while crew starts interior attack,
- A good assortment of ground ladders to choose from,
- Tag axle technology would eliminate the need for tillerman and increase maneuverability.

The following is a list of disadvantages of using quint apparatus based on literature review and telephone interviews:

- Too big and heavy, too complicated, too expensive, high maintenance and repair cost,
- Loss of both engine and truck capabilities, if taken out of service for repairs,
- A tandem axle requirement on apparatus more than 20,000 pounds, which adds cost and loss of maneuverability,
- Street lights, trees, tight turns and power lines limit the exact placement of quints,
- An expensive piece of equipment to wear out on EMS calls,
- May add additional cost to purchase smaller apparatus for EMS calls,
- Hose compartments limited because of aerial ladder and extra equipment needed to do both truck and engine company operations.

### **3. How does staffing effect quints and fireground operations?**

Staffing was based on certain critical tasks that have to be performed at a typical structure fire, not necessarily how quints are staffed. The eight critical tasks are based on the safety of firefighters while they perform the necessary tasks to prevent the loss of civilian lives and stop further property loss. A moderate risk structure fire requires a minimum of 13 firefighters on the scene to perform critical tasks safely and effectively.

The literature review and telephone interviews reveal several staffing level recommendations for engine companies, truck companies and quint companies, all of which called for a minimum of four personnel on each piece of equipment, with the exception of Gainesville Fire and Rescue. When the quint from Gainesville was staffed with four, it performed as a truck company. When staffing fell to three, they could only perform engine company operations. Gainesville also responds one rescue company staffed with two firefighters, which increases the number of firefighters on the fire scene.

In Richmond Fire Department the total quint concept allowed them to reduce the department by 50 members and respond 17 to 18 personnel to the fire scene. This was accomplished by responding three quints, staffed with four personnel, and one heavy rescue staffed with seven personnel.

By changing to total quints in 1987, the St. Louis Fire Department increased the number of personnel on the fire scene from 13 to 28. St. Louis first alarm assignment brings five quints, staffed with four personnel, one heavy rescue squad and two battalion chiefs.

Based on a series of textbook training drills and live fire drills, the Seattle Fire Department calculated that six personnel are needed for engine companies and truck companies to be 100 percent effective.

The Phoenix, Arizona Fire Department 1991 study concluded that 15 personnel are needed to conduct an aggressive interior attack and perform critical tasks. This equates to four personnel on pumpers and four personnel on truck companies.

Providence, Rhode Island Fire Department study showed that four firefighter staffing led to a 23.8 percent reduction in injuries and a 71 percent decrease in time lost due to injury, when compared to three person staffing. This research correlates with the Wilson Fire/Rescue Services research for the 1997/1998 budget report, which shows an increase of 86 percent sick leave usage and 40 percent increase of vacation taken.

The OSHA two-in/two-out regulation (29 CFR 1910.134) may be one of the most significant factors to face the fire service since its beginning. This standard is also consistent with NFPA 1500, which requires four trained, full equipped firefighters be on the scene before commencing an interior fire attack (Seymour, 1998). To perform a legal fire ground operation, three member crews would have to wait for additional help to arrive before making an interior fire attack.

An unexpected result of this research was the staffing of engine and truck companies with four personnel, and in some cases additional personnel to respond in heavy rescue vehicles. It was assumed by this researcher that most fire departments operate with three member engine and truck companies on a daily basis.



## DISCUSSION

The results of the study showed that there are distinct differences between how fire departments utilize quints. The differences range from total quint concept (TQC) to operating quints primarily as engine companies.

The advantages of quints far out weigh the disadvantages found. Maneuverability of quints compared to engines was the primary disadvantage noted. This could be overcome by utilizing the tag axles technology, which enables the rear wheels to turn in relationship with the front, which provides a smaller turning radius than traditional pumpers. Most departments surveyed were not aware of this capability. Other disadvantages such as; difficulty of operations, high repair and maintenance cost could be overcome with training and a preventive maintenance program. To alleviate wear and tear on quints, a small rescue vehicle could be utilized in quint stations for EMS calls.

Much information was gathered on how to staff engines and trucks, but other than telephone interviews and the total quint concept (TQC), little information was available on the staffing level for quints. However, no matter what type apparatus was used, the overwhelming recommendation was to staff at least four personnel on each apparatus. The critical tasks needed to be performed at structure fires and the studies on company effectiveness validate this recommendation.

Providence, Rhode Island study showed four firefighter staffing led to substantial reduction in injuries compared to three firefighter staffing. This data correlates with the 126 percent increase in the Wilson Fire and Rescue Services sick leave and vacations usage, since three firefighter staffing was implemented.

The total quint concept (TQC) has helped many larger departments increase services while also reducing department staffing. This has worked well in larger departments with more resources, but it cannot be done in Wilson according to the data on critical tasks and firefighter safety. Wilson Fire/Rescue Services presently has five engines and one truck company staffed with three firefighters in newly located stations.

The major advantage of quints over traditional engine and truck company operations is they carry both engine and truck equipment and perform the duties of both, provided enough personnel are available on the apparatus. The aerial ladder on quints can enhance the ability of firefighters to safely perform roof work and rescue operations. If five quint personnel are available and carefully coordinated, some simultaneous operations can be accomplished.

Given with the reorganization described in background and significance and literature review, Wilson Fire/Rescue Services primary need is to increase staffing of engine companies to handle the critical tasks, as well as, OSHA's two-in two-out regulation. Standard operating procedures will need to be developed to identify the role of quints in Wilson Fire/Rescue Services.

## **RECOMMENDATIONS**

After completion of this applied research project, this researcher feels it is imperative for managers to place a greater emphasis on the planning, organizing and controlling resources. This is important for maintaining firefighters' safety and providing the highest level of service possible to taxpayers at a reasonable cost. The day of the fire chief asking for more personnel and equipment without complete justification is a thing of the past. Future leaders must be

prepared to continually look for more efficient and effective ways of doing business.

The following recommendations are supported by the data collected, and its analysis and interpretation.

1. Recommend hiring six additional firefighters to offset the increase in sick leave and vacations. This will also allow all companies to operate with four personnel at all times, and also perform the necessary critical tasks on the fire scene more effectively and safely. As stated, the OSHA's two-in/two-out regulation requires that personnel work as a team inside the structure, and a minimum of two firefighters be on standby outside the structure to provide assistance or perform a rescue of an inside team.
2. Consider the replacement of the present truck company with the 105 foot quint, which is due for delivery in October, 1998. This will allow more personnel to respond on the quints and distribute more personnel to other engine companies. All companies will have four personnel at all times, which gives them more flexibility and safety on the fire scene. Appendix A will show the recommended realignment of personnel.
3. Consider purchasing a smaller rescue vehicle to respond additional personnel and handle all EMS calls at quint stations. This will eliminate much of the wear and tear on the more expensive quint fire apparatus.
4. Form a committee to study and make changes in standard operating procedures to accommodate the changes in assignments. This change could be considered a form of the total quint concept (TQC), whereas, a quint will be responding on fire calls and arrive either first or second on the fire scene.

5. Develop preventive maintenance programs for all trucks, especially quints, since out of service for repairs would mean a major loss in versatility and a change in fire scene tactics.
6. Train members thoroughly in the standard operating procedures developed by appointed committee. As new employees are added to the team, it is important that they receive the same training.
7. It is the recommendation that additional research into the future trends of the fire service and technological advancements in fire apparatus be performed before purchasing any additional quints.

## REFERENCE

- Benson, Vern (January 1983). Firehouse Magazine. Making The Quint Essential, p. 21.
- Dawson, Edward J. (February 1990). Quint Operations - Initial Attack Capability. National Fire Academy Applied Research Paper, p. 11.
- Gary, Steward (1997). Standard of Response Coverage. For California State Fire Academy - Assloman, pgs. 25, 49 - 68.
- Gerner, Gregg and Schaper, Frank C. (February 1995). St. Louis Goes to Quint. Firefighter News, p. 43.
- Gerner, Gregg and Schaper, Frank C. (February 1996). Firehouse. Total Quint Concept, pgs. 80 - 83.
- Hatch, Tim W. (April 1996). American Fire Journal. Some Hints About Quints, p. 21.
- International Fire Service Training Association. (1980). Fire Apparatus Practices. (6th ed.) Stillwater, OK.
- Knotes, Lawrence J. (December 1995). International Fire Service Training Association. The Practical and Physical Consideration in Selecting Quints for the Los Angeles city Fire Department. National Fire Academy Applied Research Paper, p. 5.
- Loeb, Donald L. (September 1992). Fire Chief. Quotes on Quints, Part I, p. 47.
- Manning, Bill (February 1998). Fire Engineering. The "Final Rule" Ideal Collides with Reality, p. 4.
- Marinucci, Richard (March 1998). International Association of Fire Chiefs, pgs. 1, 3, 5.
- Mcelfish, Jack K. (March 1998). Fire Rescue Magazine. Quint City U.S.A. Trading up to a Total Quint System, p. 28.
- National Fire Academy, (1997). Executive Planning (SMOC). Student Manual, pgs. 1-3.
- Schaper, Frank (June 1991). ISFSI The Voice, p. 21.
- Strock, Roger W. (1994). Strategic Analysis of Fire Department Operations. Montgomery County, Maryland, National Fire Academy Applied Research Project, p. 8.

**Varone, Curtis J. (1994). National Fire Academy Applied Research Paper. Providence, Rhode Island Fire Department Staffing Study. Emmitsburg, Maryland, p. 16.**

**Varone, Curtis J. (1995). National Fire Academy Applied Research Paper. Providence, Rhode Island Fire Department Staffing Study Revisited, p. 18.**

**APPENDIX A**  
**(RECOMMENDED QUINT REALIGNMENT)**

### PRESENT COMPANY STAFFING ASSIGNMENTS

NUMBER OF PERSONNEL	20	21	22	23
SQUAD 1	2	2	2	2
TRUCK 1	3	4	4	4
ENGINE 1	3	3	3	4
ENGINE 2	3	3	3	3
ENGINE 3	3	3	4	4
QUINT 4	3	3	3	3
ENGINE 5	3	3	3	3

In 1997 an average of 3 personnel were off daily; therefore, leaving 20 personnel to staff operations division which equates to three member companies.

### PROPOSED COMPANY STAFFING ASSIGNMENTS WITH TWO QUINTS AND SIX ADDITIONAL FIREFIGHTERS

NUMBER OF PERSONNEL	22	23	24	25
SQUAD 1	2	2	2	3
QUINT 1	4	4	5	5
ENGINE 2	3	4	4	4
ENGINE 3	4	4	4	4
QUINT 4	4	4	4	4
ENGINE 5	4	4	4	4

If 3 personnel were off duty this would still leave four personnel in each company except one, and according to data, sick leave should decline with four person crews